CLAIMS

1. A fibre optic grating sensor comprising an optical fibre having a grating portion along which the refractive index of the fibre varies periodically and at least substantially continuously to form an at least substantially continuous grating structure, the periodic variation having an amplitude envelope which includes at least one region in which the amplitude of the envelope is substantially reduced, the said variation giving the grating portion a spectral profile within which there is at least one pass band.

2. A sensor according to claim 1 in which the amplitude envelope includes a plurality of regions in which the amplitude of the envelope is substantially reduced.

3. A sensor according to claim 2 in which the amplitude envelope includes a plurality of regions in which the amplitude of the envelope is substantially nulled.

4. A sensor according to claim 2 or ~~3~~ in which the periodic variation in the or each region includes a section in which the phase of the periodic variation substantially reverses.

5. A sensor according to any of claims 2 to 4 in which adjacent regions are spatially separated.

6. A sensor according to any preceding claim in which the or each region gives rise to a corresponding pass band.

7. A sensor according to claim 6 in which each region is an independently actuable sensor element operable to vary the wavelength of the corresponding pass band in response to a change in a parameter being measured.

8. A sensor according to ~~any~~ preceding claim in which the grating portion comprises two substantially superimposed fibre Bragg gratings.

9. A sensor according to claim 8 in which the amplitudes of the refractive index profiles of the two gratings add together to form the amplitude envelope.

Sub a1

10. A sensor according to claim 8 or 9 in which the fibre Bragg gratings are chirped fibre Bragg gratings.

11. A sensor according to claim 10 in which the two chirped gratings have substantially the same rate of chirp and substantially the same spectral bandwidth, the first chirped grating having a different central wavelength to the second chirped grating.

12. A sensor according to claim 10 in which the first chirped grating has a different rate of chirp to the second chirped grating, and the two chirped gratings have substantially the same central wavelength and bandwidth.

Sub a2

13. A sensor according to claim 8 or 9 in which the fibre Bragg gratings are linear fibre Bragg gratings.

14. A sensor according to claim 13 in which the two linear gratings have substantially the same spectral bandwidth.

15. A sensor according to claim 14 in which the first linear grating has a different central wavelength to the second linear grating.

Sub a3

16. A sensor according to any of claims 1 to 7 in which the grating portion comprises one fibre Bragg grating having a plurality of regions within which the refractive index profile of the grating is substantially reduced or nulled.

17. A sensor according to claim 16 in which the fibre Bragg grating is a linear grating or a chirped grating.

Sub a4

18. A sensor according to any of claims 8 to 17 in which the or each fibre Bragg grating is fabricated using a two-beam interference holographic

fabrication method.

19. A sensor according to any of claims 8 to 17 in which the or each fibre Bragg grating is fabricated using a phase-mask fabrication method.

20. A sensor according to claim 18 when dependent on claim 16 or 17 in which the or each region in the fibre Bragg grating is formed in a fibre Bragg grating fabricated using the two-beam interference holographic fabrication method by providing an amplitude mask generally in front of the fibre, generally in the beam paths, during fabrication.

21. A sensor according to claim 18 or 19 when dependent on claim 16 or 17 in which the or each region in the fibre Bragg grating is formed in a fibre Bragg grating fabricated using the two-beam interference holographic fabrication method or the phase-mask fabrication method by subsequently further exposing regions of the grating.

22. A sensor according to any of claims 1 to 7 in which the grating portion comprises a single grating structure fabricated using a phase-mask fabrication method.

23. A sensor according to claim 22 in which the desired grating structure is represented on a phase-mask and subsequently inscribed into the fibre through the phase-mask.

24. A sensor according to claim 22 in which the grating structure is inscribed in the fibre through a phase-mask while the fibre undergoes oscillating motion along its longitudinal direction, relative to the phase-mask, to thereby control the refractive index profile within the grating structure.

25. A fibre optic grating sensor comprising an optical fibre having a grating portion along which the refractive index of the fibre varies periodically and at least substantially continuously to form an at least substantially continuous grating structure, the periodic variation including at least one section in which

the phase of the periodic variation substantially reverses, the said variation giving the grating portion a spectral profile within which there is at least one pass band.

26. A sensor according to claim 25 in which the grating portion includes a plurality of sections in which the phase of the periodic variation substantially reverses.

27. A sensor according to claim 26 in which adjacent phase reversal sections are spatially separated.

28. A sensor according to any of claims 25 to 27 in which the or each phase reversal section gives rise to a corresponding pass band.

29. A sensor according to claim 28 in which each section is an independently actuable sensor element operable to vary the wavelength of the corresponding pass band in response to a change in a parameter being measured.

30. A sensor according to any of claims 25 to 29 in which the period of the periodic variation changes along substantially the full length of the grating portion.

31. A sensor according to any of claims 25 to 30 in which the grating portion comprises two substantially overlapping chirped fibre Bragg gratings, the first chirped grating being spatially shifted relative to the second chirped grating by an integer plus a fraction of the period of the first grating.

32. A sensor according to claim 31 in which the first chirped grating is spatially shifted relative to the second chirped grating by an integer plus one half of the period of the first grating.

33. A sensor according to claim 31 or 32 in which the two chirped gratings have substantially the same rate of chirp and substantially the same spectral bandwidth, the first chirped grating having a different central wavelength to the

second chirped grating.

34. A sensor according to claim 31 or 32 in which the first chirped grating has a different rate of chirp to the second chirped grating, and the two chirped gratings have substantially the same central wavelength and bandwidth.

35. A sensor according to any of claims 31 to 34 in which the fibre Bragg gratings are fabricated using a known two-beam interference holographic fabrication method.

36. A sensor according to any of claims 31 to 34 in which the fibre Bragg gratings may be fabricated using a known phase-mask fabrication method.

37. A sensor according to any of claims 25 to 30 in which the grating portion comprises one chirped fibre Bragg grating having a plurality of sections in which the phase of the periodic variation substantially reverses.

38. A sensor according to claim 37 in which the single chirped fibre Bragg grating is fabricated using a known phase-mask fabrication technique.

39. A sensor according to claim 38 in which a first part of the chirped grating having a first spectral bandwidth is represented on a phase-mask and subsequently inscribed into the fibre.

40. A sensor according to claim 39 in which a second part of the chirped grating having a second spectral bandwidth is inscribed into the fibre substantially spatially and spectrally adjacent the first part, the first and second parts together forming the chirped grating.

41. A sensor according to claim 40 in which the chirped grating comprises a plurality of such parts arranged substantially spatially and spectrally sequentially adjacent one another.

42. A sensor according to any of claims 39 to 41 in which the fibre is under a first strain during inscription of the first part.

43. A sensor according to claim 42 in which the fibre is under a second strain during subscription of the second part, the first and second strains being different.

44. A sensor according to claim 37 in which the chirped grating is fabricated using a single phase-mask, the desired structure of the chirped grating being represented on the phase-mask and subsequently inscribed into the fibre through the phase-mask.

45. A sensor according to claim 37 in which the chirped grating is fabricated using a known continuous writing technique.

46. A sensor according to any preceding claim in which the optical fibre is photosensitive enhanced optical fibre.

47. A sensor according to claim 46 in which the photosensitive enhanced optical fibre is germania doped optical fibre, or boron-germania co-doped optical fibre.

48. A sensor according to claim 46 or 47 in which the fibre is hydrogen loaded to increase the photosensitivity of the fibre.

49. A sensor according to claim 48 in which the hydrogen loaded fibre is annealed following fabrication of the grating structure to substantially remove any residual hydrogen from the fibre.

50. A sensor according to any of claims 1 to 7 and 25 to 30 in which the grating portion comprises a surface-relief grating structure side-etched in an optical fibre.

51. A sensor according to any preceding claim in which the fibre grating sensor comprises a plurality of grating portions.

52. A fibre optic grating sensor substantially as described above with reference to the accompanying drawings.

add a'